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# Teachers' Information Competence and Use of ICT Methods and Tools – Research Report

## Abstract

The article presents the results of diagnostic-correlative research of quantitative/qualitative character, related to information competence in teachers in the scope of the application of ICT methods and tools in the context of new trends in technology and the accompanying civilizational transformations. The methods of a diagnostic survey and statistical methods were applied (poll and narrative interview). A sample of 1160 teachers was examined and it was determined that: 1) the level of competence represented by the majority of the respondents can be described as satisfactory (in the light of standards – sufficient) to undertake activities for the implementation of ICT in professional practice; 2) there is a distinct connection (correlation: high, positive) between the level of information competence (findings in the cognitive sphere of teaching achievements) and the level of application of modern ICT tools (appropriate incentives in practice).

**Keywords:** *teachers' information competence, use of ICT methods and tools, diagnostic and correlative research*

## Introduction

The reality of the digital era confronts teachers with new challenges as well as with ever-increasing demands in the existing requirements oriented towards forming some determined areas of ICT competence, by charting relevant directions in their professional development, including the area of application of the latest ICT trends in educational practice. Contemporary teachers are expected to support

their professional incentives (subject-teaching and general education) with ICT. Therefore, the fundamental purpose of the research and by the same token, its main problem, whose solution constitutes a focal point, revolves around establishing the level of ICT competence as far as application of ICT methods and tools is concerned, in the context of the latest trends in technology and the accompanying civilizational transformations. The findings make it possible to isolate the features of the educational environment in the post-modern world implicated by the sudden onset of ICT technology.

## Theoretical and methodological foundations of the research

From the perspective of pedagogical research methodology, at the conceptual stage of the research it was decided that the undertaken research activity would assume a diagnostic-correlative form (Ferguson, Takane 2003: 33) of quantitative/ qualitative character (Dróżka 2010: 125), nested mainly in media pedagogy and pedeutology.

The main research problem comprises five detailed problems (four of diagnostic and one of dependence character). The first problem (question) deals with the recognition of the level of ICT competence in teachers in terms of handling information, the second, with the recognition of the level of teachers' use of modern ICT tools, the third, with establishing a connection between the level of teachers' information competence and its practical implementation, the fourth, with determining ICT infrastructure, and the fifth, with the recognition of the extent of teachers' familiarity with, understanding and use of the latest trends in ICT, as well as their reflection on the undertaken (or not undertaken) practical incentives in the area of ICT application.

Focusing on motivational factors (both internal and external), necessary to undertake incentives, problems streamlined the process of description, explanation and interpretation of teachers' reflections on the types of reasons and arguments which induced them to make use or not of ICT tools in their educational practice; their special achievements and failures in the area of administering ICT; their motives and reasons for designing (or not designing) their further professional development, as well as their expectations in terms of forms and techniques of instruction (self-instruction) with the aim of extending their own repertoire of ICT-in-education expertise and their expectations towards the provision of support in order to activate their ICT application in their work. The fifth problem refers to the previously framed concept (theoretical model of computer

competence in ICT application), and taking into consideration "the latest trends in ICT development" in technical/engineering context (Baron-Polańczyk 2011: 84–92).

In the attempt to develop a conception of information competence in the use and methods of ICT tools, the following was taken into account: 1) theoretical assumptions concerning the definition and the structure of the notion *competence* (cf. Czerepaniak-Walczak 2006: 129); 2) professional competence standards determined by educational requirements during teacher training programmes; 3) standards of teacher preparation in terms of information and communications technologies and computer science in relation to every contemporary teacher working at any educational stage and guidelines included in the projects propagating information alphabetization: UNESCO – ICT Competency Standards for Teachers, American Association of School Libraries, Association of Educational Communications and Technology, Society of College, National and University Libraries – The Seven Pillars of Information Literacy, Chartered Institute of Library and Information Professionals; 4) theoretical foundations concerning the application of the latest ICT trends – engineering/technical, pedagogical and ethical, legal, social and economic guidelines (Baron-Polańczyk 2011: 15–142). The adopted theoretical foundations underline one of the possible solutions for forming and developing teaching competence, take notice of the principles of modern teaching and learning embedded within the cognitivist and constructivist theory (with particular reference to social-cultural prospects), emphasising one of the methods of thinking about the formation of knowledge, i.e. learning about ICT methods and tools via ICT. It was also established, according to the guidelines of the concept of reflective professionalism (reflective teacher suggested by Schön 1987), that not so much the application of theoretical knowledge is decisive for the success of professional incentives, but rather the capability of a special type of reflection, reflection within incentives and reflection on incentives (Gołębniak 2004: 201–203).

The research on teachers' information competence in terms of ICT use was nested within diagnostic procedures (Gnitecki 1996: 105), where the method of diagnostic survey was applied (Babbie 2004: 268; Nowak 2007: 47) together with two techniques: 1) a survey in the form a questionnaire (Pilch, Bauman 2001: 96); 2) a narrative interview with instructions for discussion (Frankfort-Nachmias, Nachmias 2001: 249, 612; Konarzewski 2000: 117). The research was conducted in 2009 at some schools of Zielona Góra and some selected institutions of the Lubuskie province as well as some neighbouring provinces, embracing teachers of 23 subjects. 40 persons were interviewed, i.e. teachers working in Zielona Góra (of

four educational stages: 10 persons from every type of institution were selected). 2000 questionnaires were distributed, 1160 (58%) of which were subsequently collected. Thus, **1160 teachers** constituted the research group (the entire sample) with the following distribution according to educational stages: 150 (12.9%) in early-primary education, 340 (29.3%) in primary education, 267 (23.0%) at lower secondary level, 276 (23.8%) at upper-secondary school. Females constituted a straight majority – 925 (79.7%) with males representing merely a fifth of the entire sample, i.e. 235 (20.3%) teachers. A significant percentage (73.5%), i.e. 852 teachers, boasted the highest level of professional qualifications at the rank of an appointed or a registered teacher.

The results presented in the article are of general character, constituting a selection of guidelines and conclusions (detailed analyses, comprehensive results and their visualisation is available from: Baron-Polańczyk 2011).

## Analysis and interpretation of results

The analysis of the literature on the subject and the gathered empirical material, as well as the applied methods and research techniques, including calculations with the use of statistical methods, led us to the following conclusions.

### The area of ICT competence (1)

The level of teachers' information competence may be determined as average (a half of the examined group) or high (almost a third of all the researched teachers). This may attest to the generally satisfactory level of preparedness in teachers to solve problems related to handling information, or at least sufficient for the application of modern tools for solving practical ICT problems. The teachers, in their declarations, are able to apply knowledge in order to achieve a preset result (such as solving an ICT problem) by effective application of the performed activities (retrieving, sorting ,etc., of information), which may largely manifest itself with accuracy in the pre-established outcome, and for many (9.8%) the results may even assume a creative and innovative dimension. However, we should not forget that the fragmentary competencies included areas which require particular attention and care in order to upgrade their levels through constant self-improvement.

**The area of ICT application (practical incentives) (2)**

The extent to which the teachers make use of modern ICT methods and tools may be established as average (exactly a half of the examined persons) or high (a third of the analysed group). The diagnosed state is satisfactory, as almost the entire community (97.5%) admit that they undertake practical incentives (at the level corresponding to the level of the targeted pupils) in the area of ICT application in their educational practice. The high level of teachers' initiatives and their active approach to ICT hardware, software and online instruments, as well as multimedia technologies in the educational environment are all naturally very reassuring. It may attest to perhaps generally satisfactory teacher training in this respect.

**The area of connection between ICT competence and usage (3)**

The declared self-assessment of information competence is directly reflected in educational practice aimed at the implementation of ICT into school environment (Table 1; the image of frequency distribution of both variables assumes a similar course, close to normal). Statistical calculations (making use of the chi-squared test and Pearson's coefficient correlation) (Nowaczyk 1995: 98–105; Juszczyk 2004: 166–171) led us to the formulation of the following statements:

1. The level of the teachers' use of modern ICT methods and tools is dependent on the level of their information competence (p = 1.5605E-244 < α = 0.01; for *df* = 9).
2. Fifty percent of changeability in the level of practical incentives undertaken by the teachers in terms of ICT application may be predicted on the basis of the changeability of their information competence (r2 @ 0.50).
3. The correlative connection between the level of the teachers' information competence and the level of their practical ICT application is high (r @ 0.71); the correlation is positive and expresses one-way changes in both considered features.
4. Among the numerous analysed diversifying factors, such features as: gender; age; teaching experience; level of professional promotion; the taught subject; locality; the degree of interest in technology and computer science as disciplines of knowledge have all revealed statistically pertinent differences between the factors and information competence and/or the level of the use of ICT tools.

Thus, there is a distinct connection between the level of information competence (findings in the cognitive sphere of teaching achievements) and the level of modern ICT tool application (appropriate incentives in practice).

**Table 1.** ICT use in the function of information competence

| Level | | ICT use | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | 1 very low | 2 low | 3 medium | 4 high | 5 very high | |
| Information competence | 1 very low | 6 | 3 | 0 | 0 | 0 | 9 |
| | 2 low | 9 | 49 | 28 | 3 | 0 | 89 |
| | 3 medium | 11 | 32 | 465 | 78 | 0 | 586 |
| | 4 high | 2 | 5 | 81 | 252 | 21 | 361 |
| | 5 very high | 1 | 1 | 6 | 52 | 55 | 115 |
| Total | | 29 | 90 | 580 | 385 | 76 | 1160 |

### The area of ICT infrastructure (4)

Free access to the computer and Internet connection at home was declared by almost the entire examined population (95.9%), and in the workplace by the majority of them (81.5%). Unlimited access to a school computer room in order to run classes was declared by over a half of the respondents (58.5%). In the context of the encountered problems and restrictions in the application of ICT equipment in computer rooms, the majority of the teachers indicated the state of ICT infrastructure at their school and organization of working procedures as leading obstacles (mostly, fully booked computer rooms for the purpose of ICT classes, insufficient number of computers and/or computer rooms at school, school timetable and excessive number of pupils per class). The remainder of the respondents (10%) pointed at obstacles related to the teacher in charge of ICT classes and computer room(s) at school or to their own personal attributes, i.e. insufficient level of knowledge and skills, deep subjective conviction about irrelevance or even pointlessness of ICT application in teaching.

### The area of teachers' knowledge, understanding, incentives and attitudes towards the latest trends in ICT (5)

#### The cloud computing technology (5.1)

Every sixth teacher declared that he/she was familiar with the notion *cloud computing*. Merely 22 (1.9%) teachers apply this technology in their professional practice. Only 14 teachers were able to provide tangible examples of tools and technological solutions applied in their practice. Thus, there are justified doubts concerning the credibility of these declarations.

**Motives behind applying and not applying ICT (5.2)**

Some fundamental reasons why teachers make use of ICT in their educational practice are rooted chronologically in: a) the conviction that they make their work more efficient and practical (beneficial for teachers themselves); b) the great potential for making the processes of teaching and learning more efficient and practical (profits for the teacher and the pupil); c) the appreciation of ICT as a universal and practical instrument applicable to a wide array of educational incentives (positive features of digital tools); d) the holistic insight into improving and optimizing teachers' professional practice and pupils' learning process, as well as into appreciation of technology as a modern, universal and useful instrument, supporting diverse, professional and non-professional incentives (in benefits for the teacher, the pupil and the attributes of ICT); e) the broad applicability of modern technologies in stimulating the learning process and in supporting the pupils' development (benefits for the pupil); f) outside conditioning, i.e. the need, compulsion, order or duty, in other words, external motivation (zeitgeist, global requirements).

The main arguments against the application of ICT in educational practice point at some restrictions rooted in: a) the lack of appropriate technical and organisational conditions (inadequate provision and functioning of a given institution); b) the lack or insufficient competence to make use of ICT; c) the lack of time (time-consuming activities associated with organising and running computer-aided classes); d) the non-existent internal necessity for tracking and administering the latest technological trends in educational practice e) the conviction that this problem and the requirement is not directed towards teachers.

**The frequency of ICT application (hierarchy of importance) (5.3)**

In general understanding of the hierarchy of importance, established according to the frequency of the teachers' use of ICT tools in some selected areas of incentives, there is a distinct dominance of three areas. Preparation for classes aided by computers was recognized by the teachers as the most important activity. Then, they located the use of ICT to seek and create digital information, revealing that processing information according to their own interests held a degree of significance for the respondents. Online communication was ranked as third, with the emphasis that electronic mail, discussion lists and groups, chat rooms and instant-message communicators were all important for them. Then, (further down in the level of importance) leisure time and digital means of recreation were selected. In general, the teachers fail to make use of ICT instruments to play and entertain. Computer games seem to play little role for teachers, and for many no role at all.

Achievements and failures in the field of ICT (5.4). The analysis of the teachers' reflective self-assessment in the area of ICT application revealed a very colourful and expressive image of represented competence and displayed, or not displayed, practical incentives, and as such, it proved that failures in many areas constituted a mirror reflection (inverted) of the enumerated successes. Most frequently, every third respondent referred to their successes or failures in the area of ICT implementation in educational practice, as well as to the processes of designing, constructing and implementing multimedia presentations. When attaching considerable significance to professional duties, the teachers often referred to achievements and failures in the area of self-development, in the level of competence (almost a quarter), in this way revealing their awareness of the requirement for permanent training and professional self-education within the area of ICT. Further afield, achievements and problems of technical or instrumental nature were addressed, where the following were pointed out: creating websites, a single, selected application of the Microsoft Office package, Microsoft Office applications in general and specialist software. Many respondents regarded managing information as their special achievement or failure in the area of using ICT tools and marked the level of presented efficiency, or obstacles in effective information search or data acquisition on the Internet. Self-reliance and freedom (or their lack) in using digital tools were enumerated as markers of success or failure. It is clearly seen that in sentences referring to achievements observations of pedagogical (taking into account pupils' educational needs, psychological foundation of ICT-aided learning, teaching/learning about ICT and/or via ICT) and axiological nature prevail. On the other hand, opinions referring to failures focused more on engineering-mechanical areas (concerning software, ICT equipment, Internet technology).

Self-improvement and self-education in the field of ICT (5.5). The majority of the respondents include broadening of the scope of knowledge and skills related to ICT application in their plans of professional development. The reasons why the teachers plan their subsequent development of their competence in the area are rooted in their internal judgment, in the personal need for development (a third of them), as well as in tangible benefits for their educational practice (less than a third of them). Every fourth respondent justifies his or her plans with the challenges of the 21st century, the requirements of the contemporary world with its changes, i.e. external conditioning. For many, a premise of planning the development is rooted in access to adequate ICT tools, with their technical and ergonomic advantage or an external requirement, as well as in the dictate of administering ICT tools in educational practice.

Amongst many established reasons why the teachers fail to plan the extension of their knowledge and skills, there are those arguments that point at the necessity of an appropriate, truly satisfactory level of represented competence in ICT (every second person) and lack of time (every fifth respondent). The remainder of the respondents enumerate: different intentions and professional objectives (mainly retirement), participation in another organised form of training (participation in training completing courses) and lack of interest in ICT, financial constraints, or even disinclination to learn.

In order to upgrade their own competence in the field of ICT, the teachers would most willingly make use of courses and training, preferably short and free of charge, mainly those organised by ODN or WDN (teacher training centres) (the majority of the respondents), workshops with the emphasis on practical exercises shaping computer abilities (every fourth respondent), as well as contemporary digital means, such as multimedia teaching materials and systems of remote education by the Internet (every ninth teacher). Other choices include the following: postgraduate education, self-study, i.e. independent learning about ICT, conferences, seminars and the like, paper publications (books, textbooks, magazines), private lessons and consultations guaranteeing individualization of the teaching process.

Expectations in the area of support for the incentives undertaken in favour of ICT application (5.6). The teachers, in order to apply ICT to their work more actively, expect some sources of support in their professional environment. They expect support which is: a) formalised, professional, institutionalised – provided by institutions and organs of the education system (schools, teacher training institutions, such as ODN, WOM, CKU, higher education institutions and MEN (the Ministry of Education), publishing companies etc.); b) non-professional, not formalized and mutual – provided by naturally formed groups and particular individuals (ICT teacher and other co-workers, family, friends, etc.). The respondents count on the support of: a) instrumental and/or cognitive character (over a half of the respondents); they expect specific aid provided in the form of briefing, description, explanation, display or demonstration in the area of practical application of ICT in the teaching practice; b) financial character (fewer than a half); they expect, e.g., specific material and financial help (on the part of school and its management); direct physical incentive, top-down support and, what is more, exclusively within the subject-matter of a given subject, as well as footing all the cost of ICT training (by governmental institutions); tool support in the form of delivering ready-made teaching materials (from educational publishing houses). It is also remarkable that every seventh respondent, providing an answer "from nobody" or "by myself", does not really seek external support at all, but relies chiefly on his or her own, individual resources.

## Summary

In relation to the forwarded general methodological predictions, we may acknowledge that there is a distinct connection between the level of the teachers' information competence in using information and the level of their application of modern ICT tools. Since a half of the variance of one variable (ICT application) may be predicted on the basis of the variance of the second variable (teaching competence), then we are confronted with a pertinent connecting power, high correlation between practical incentives and the level of represented knowledge and ability. Depending on whether and to what extent teachers have mastered the modern sources of information and the art of solving information problems (searching, organising, selecting, storage, creating and providing access to digital information), the extent of application of modern ICT tools, such as: ICT equipment, software, Internet technologies, multimedia teaching materials, in teachers' educational practice will vary. One of the determinants conditioning positive attitudes in the field of the application of modern digital tools for educational purposes is included within the appropriateness of the level of competence, which is in turn conducive to (especially in the light of contemporary technological progress) permanent professional development aimed at the extension of one's knowledge and abilities in terms of the latest ICT trends.

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